United States Patent [19]

Redmon, Jr. et al.

[11] **Patent Number: 4,821,610**

[45] **Date of Patent: Apr. 18, 1989**

[54] **SELF-LOCKING CLAMPING TOOL WITH SWIVEL JAWS**

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[21] Appl. No.: **87,370**

[22] Filed: **Aug. 20, 1987**

[51] **Int. Cl.**[4] **B25B 7/14**

[52] **U.S. Cl.** **81/322**; 81/418; 81/387; 269/258

[58] **Field of Search** 81/322, 320, 321, 323, 81/324, 325, 326, 327, 328, 329, 330, 331, 332, 348, 405, 406, 407, 424, 425.5, 385, 386, 387, 392, 393, 394, 346, 347, 352, 381, 16, 15.9, 450, 417, 418; 269/6, 258

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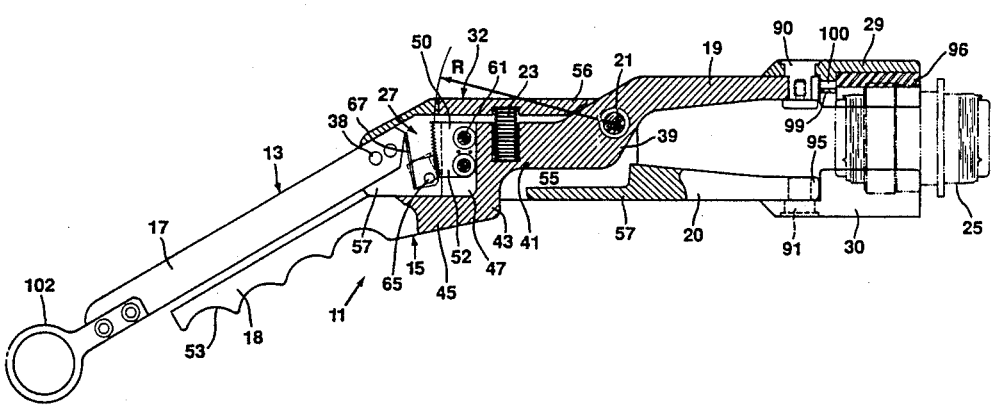
[57] **ABSTRACT**

A plier-like tool (**11**) having two plier-like members (**13, 15**) pivotally joined togther intermediate of their ends and having handle portions (**17, 18**) and swivel jaw members (**29,30**). An automatic locking mechanism (**27**) extending between the members permits an user to clamp the handle portions together so as to clamp the jaw members on an object (**25**) but holds the position so reached if the clamping action of the user is removed. A release device (**65**) is provided so that the jaw members may be opened up again. A compression spring (**23**) extending between the members (**19, 20**) assists in the opening of the jaw members. The swivel jaw members (**29, 30**) permit the user to rotate the plier-like members (**13,15**) relative to the object (**25**) being grasped.

8 Claims, 3 Drawing Sheets



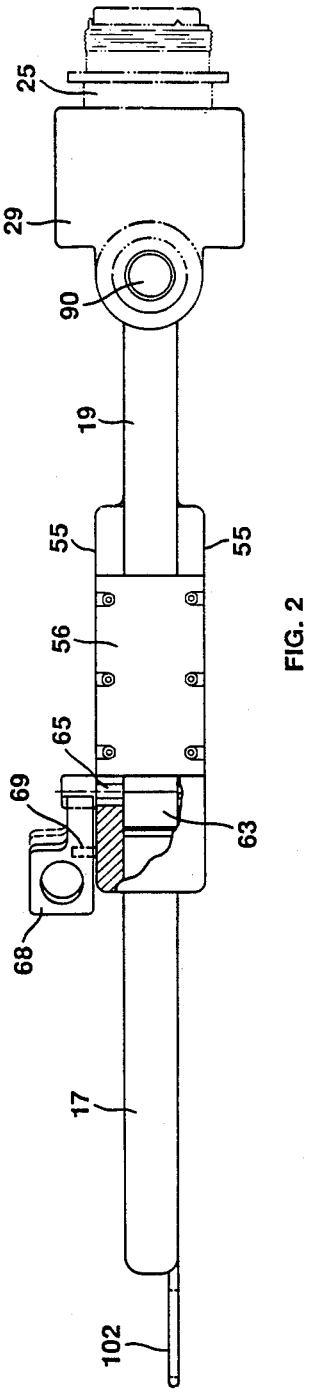

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FIG. 2

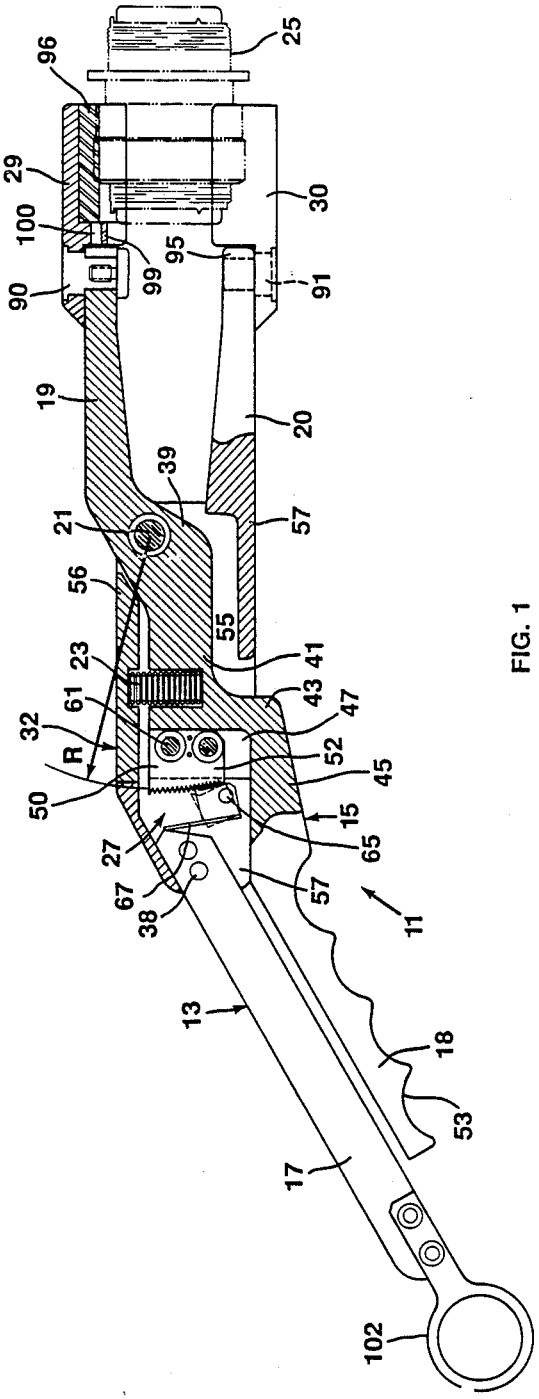
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FIG. 1

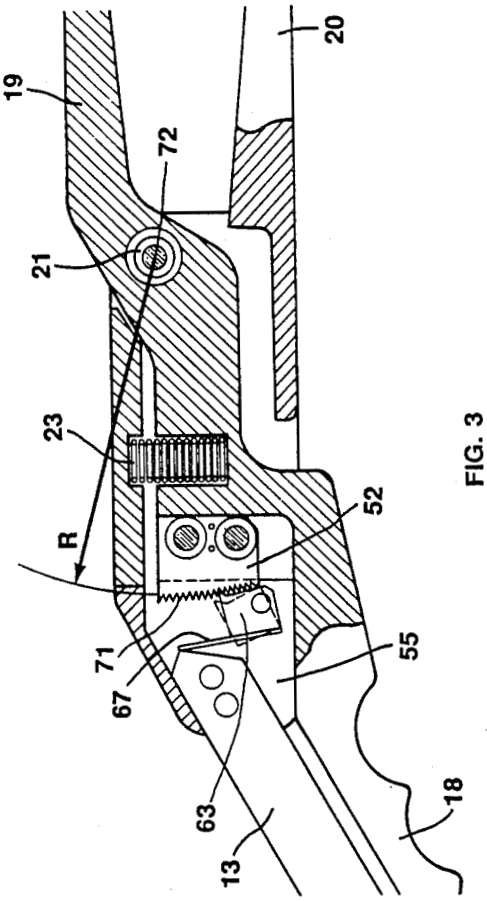

FIG. 3

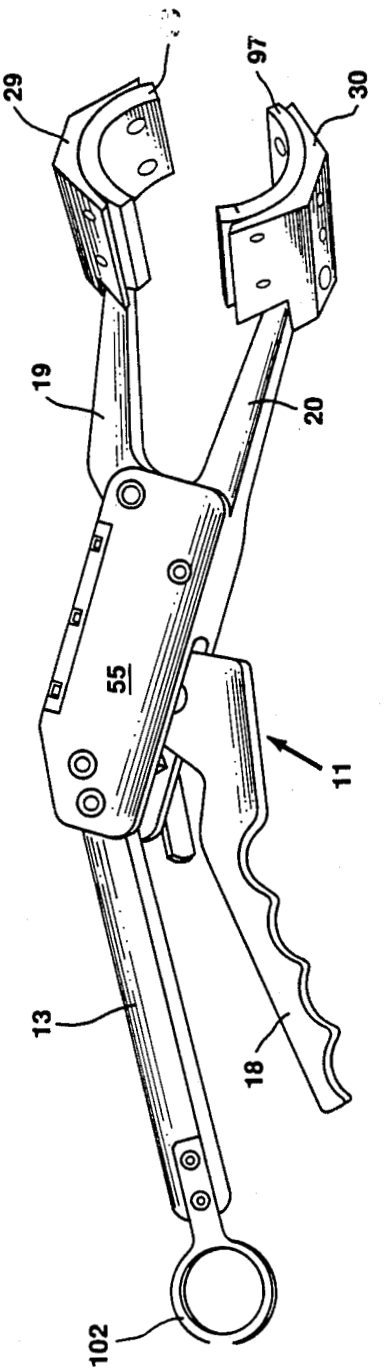

FIG. 4

SELF-LOCKING CLAMPING TOOL WITH SWIVEL JAWS

ORIGIN OF THE INVENTION

TECHNICAL FIELD

This invention relates to plier-like tools and more particularly to a hand tool with pivoting jaws designed for gripping an object.

BACKGROUND OF THE INVENTION

Plier-like tools conventionally have gripping jaws which are fixed at a particular angle relative to the jaws and this results in the tool user grasping or gripping an object at a set angle and generally being constrained in his movement and turning of the gripped object.

Further these plier-like tools require the user to grip the handles and turn the tool simultaneously to manipulate the object being gripped. These deficiencies in operation of plier-like tools present formidable operating problems for astronauts working in space because their pressurized suits reduce their manual dexterity. Also in the relative clamped quarters of space vehicles some objects such as electrical connectors are essentially inaccessible to direct view and the gloved hand of the astronaut when used in placing or removing an connector prevents a clear view of the connector. Sharp edges about a connector do present a problem as they could damage the glove during hand turning of the connector.

STATEMENT OF THE INVENTION

A self-locking plier-like tool to overcome the disadvantages of prior devices is provided. The new tool has swivel jaw members which permit the tool to rotate in an indexed manner along a plane relative to the object being gripped by the jaw members. The self-locking feature works automatically to permit the handle portions of the tool to be squeezed together by an user's hands causing the plier-like jaw members to squeeze and clamp an object but prevents the handle portions from opening or moving in the opposite direction so as to lose the clamping action on the object when the hand relaxes its grip and squeezing action. A release mechanism is provided to permit the handle portions and thus the jaw members to open up and release the clamped object. The swivel jaw members have rubber pads to provide a tactile feel of the jaws being clamped on an object.

The self-locking feature is accomplished by a ratchet gear fixed to one of the plier-like members cooperating with a pawl fixed to the other of the plier-like members. The release mechanism has a shaft attached to the pawl which when rotated by the action of a lever accessible to the user causes the pawl to pull away from the ratchet gear and unlock the handles and thereby permit an opening movement.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 side view partly in section of the self-locking tool according to the present invention.

FIG. 2 is a top view partly in section of the tool of FIG. 1.

FIG. 3 is a specific view of the locking mechanism for the tool of FIG. 1.

FIG. 4 is a full side view of the self-locking clamping tool with its end swiveled members rotated ninety degrees.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings, particularly FIG. 1, wherein is shown the self-locking clamping tool **11** of the present invention. As shown the clamping tool **11** comprises two plier-action members **13, 15** with handle portions **17, 18** forming one end and jaw members **19, 20** forming the opposite end. The plier-action members **13, 15** are pivotally joined together intermediate of their ends by a screw fastener **21** and have a compression spring **23** extending between the members rearwardly of the pivot point so as to assist in the opening of the jaw members **19, 20** and also to hold the jaw members **19, 20** in an opened position until it is desired to close them together to clamp on an object **25** to be grasped. In the drawings an object **25** to be grasped by the self-clamping tool **11** is shown in phantom lines as a cylindrical electrical connector.

Rearwardly of the compression spring **23** is an automatic locking means **27** extending between the members **13, 15** which locks the handle portions and jaw portions in the specific squeezed position reached and prevents their opening up should the user release or loosen his grip on the handles. The jaw members **19, 20** have swivel members **29, 30** on their distal ends to enable the clamping tool **11** to horizontally rotate up to one hundred eighty degrees relative to the object **25** being clamped thus permitting the user to have the most comfortable position for applying the clamping action and applying a turning torque on the clamped object **25**.

The first plier-action like member **13** has an upper rear handle **17**, a lower forward jaw portion **20**, and a housing structure **32** intermediate of its ends having two side plates **55**, an upper plate **56**, and a lower plate **57** that extends to form the lower jaw portion **20**. The upper handle **13** is secured by fasteners **38** to the side plates **55** forming the housing **32** and angles therefrom at an angle of about 45 degrees. These plates **55** are arranged to form a tunnel through which the second plier-action like member **15** extends and pivotally moves. As shown the second member **15** has a forward jaw member **19** that extends above the upper plate **55** and has a short angled portion **39** joining the forward jaw member **19** with a short member **41** internally of the housing. The short member **41** is thick and has a drop extension **43** which joins with a rear extending member **45** orientated similarly to the short member **41** but at a lower level. The short member **41** has integral sides **47** extending a short distance beyond the drop extension **42** so to form a first cavity **50** for a ratchet gear mount **52**. The rear handle **18** of the second member **15** integrally extends from the rear extending member **45** at an angle of about 45 degrees so as to be parallel with the upper handle portion **17**. The lower rear handle portion **18** is shorter than the upper rear handle **13** and has concaved notches **53** on its lower surface to conform with the fingers of the user and thereby provide a secure grip.

A fastener screw **21** fixed between the side plates **55** forming the housing **32** of the first member **13** extends through a pivot hole in the short angled portion **39** of

the second member **15** which permits the two plier-action like members **13, 15** to pivot relative to each other. The rearwardly extending member **45** of the second member **13** together with the upper plate **56** and side plates **55** of the second member **13** forms a second cavity **57** that communicates with the first cavity **50** formed by the short integral sides **47** and drop extension **47** of the second member **15**.

The automatic locking means **27** comprises a ratchet gear **52** partly within the first cavity **50** and secured with fasteners **61** to the two integral sides **47** extending from the short member **47** of the second plier-like member **13** and a pawl **63** within the second cavity **57** and secured to a shaft **65** extending from the side plates **55** forming the housing **32** on the first plier-like member **13**. The shaft **65** is located adjacent to the lower forward corner of the pawl block **63** so as to be eccentric thereto. As shown in FIG. **3** the ratchet gear teeth **71** are on a curve at a radius R from the pivot point **72** to form a sector and the gear teeth are configured in a forty-five degree downwardly sloping saw tooth so as to provide capture of the mating pawl **63**.

The pawl **63** has a flat cantilevered spring **67** riding at its upper end against the handle **17** ending within the housing side walls **55**. The pawl block **63** is secured to the lower part of the flat spring **67** and has an extending pick that engages a ratchet gear tooth. Thus the pawl **63** is spring loaded to engaged the ratchet **52**. The shaft **65** extends through the pawl block **63** and is secured thereto and extends into bushings within the side plates **55**. One side of the shaft **65** extends through a side plate **55** and a thumb release lever **68** is secured thereto. The shaft **65** is eccentric to the pawl block **63** so that shaft rotation in a counter clockwise rotation, as caused by pushing down on the thumb lever **68**, pulls the pawl pick away from the ratchet tooth and permits the two plier-like arms **13, 15** to unlock and open. A dowel **69** extends from the side plate **55** and located beneath the lever **68** to serve as a stop for the lever **68** after it has moved a short distance when pushed down. The dowel stop **69** prevents the over-deflection of the cantilevered spring **67** by the rotation of the shaft **65**.

Thus when release of the clamping jaws **19, 20** is desired, the handles **17, 18** are squeezed slightly to unload the pawl block pick **63**, and then the thumb released lever **68** is depressed which overcomes the cantilevered spring **67** and pulls the pawl **63** away from the ratchet **52**. As previously noted a compression spring **23** is loaded within a hole in the upper surface of the short thick member portion **41** of the second plier-like member **15** and extends into a shallow hole extending from the lower surface of the upper plate **56**. The compression spring **23** tends to assist in the opening of the plier-like members **13, 15** until is desired to once again clamp an object.

It should be noted the locking between the pawl **63** and ratchet **52** is augmented by the geometric relationship between the pawl, pawl shaft and ratchet gear because the point of tangency the pawl tooth shares with the ratchet gear causes the clamping load to load drive the tooth into further engagement as the load increases.

The swivel members **29, 30** on the distal ends of the principal elongated jaw members **19, 20** are shown are in the shape of half-circles for grasping a circular electrical fitting **25** shown in phantom lines in the drawings. Each swivel member **29, 30** is pivotally mated to a fastener dowel **90, 91** extending downwardly through the distal end of an elongated jaw member **19, 20**. Thus the swivel members **29, 30** rotate about an axis perpendicular to the horizontal axis of the plier-like members **13, 15** and permit the members to swing or rotate in a 180 degrees arc relative to the object **25** to be clasped by the swivel members. The vertical face **95** of each end of the jaw members **19, 20** are curved and have a radius corresponding with the dowel location.

Elastomeric or rubber pads **96, 97** (see FIG. **4**) are riveted to the inner surface of the swivel members **29, 30** to provide friction, a tactile feel, and to minimize damage from chafing. The rubber pads **96, 97** conform to the shape of the object **25** being grasped and provides a force when compressed to enhance the pawl **63** engagement. Also as illustrated each swivel member **29, 30** has an inward extending rib **99** adjacent the vertical face of its jaw member which includes a ole confining a spring loaded detent **100** which rides against the curved end face **95** and frictionally holds the swivel member **29, 30** in a desired angular position until clamping is effective.

As the self-clamping tool **11** is designed to fit the needs of the astronaut in space it also has a tether loop **102** fastened to the handle end **17** of the first member **13** to provide a means of keeping the tool **11** at hand should the astronaut need to let go of it temporarily. The tether is usually attached to the astronauts wrist so as keep the tool from floating away in the micro-gravity environment.

It is apparent that a unique clamping tool has been described having a useful locking feature and swivel jaws. It is quickly and easily positioned, locked, and released. It provides to the user a tactile feel of the object being grasped and it requires no adjustment. It frees the user from using his hands for continuous clamping of the handles and therefore enables the user more hand articulation. While the tool has been described relative to its orientation of parts by terms such as upper and lower this is simply a matter of convenience in referring to the drawings and should not be construed as requiring that orientation since the reversed orientation of the tool will function in the same manner.

While the invention has been described relative toa specific embodiment, it is evident that modifications and changes may be made thereto without departing from the scope of the claims.

What is claimed is:

1. A clamping tool comprising:

a first member having a rear handle portion and a forward jaw portion;

a second member having a rear handle portion and a forward jaw portion;

said first and second members being pivotally connected to each other intermediate their ends whereby the handle portion of said first member is above the handle portion of said second member and the jaw portion of said second member is above the jaw portion of said first member so as to have a plier action;

a pair of opposing swivel jaw members;

one of said swivel jaw members rotatively mounted to the end of the jaw portion of said first member, and the other of said swivel members rotatably mounted to the end of the jaw portion of said second member whereby pivoting the handle portions away from each other will pivotally open the opposing swivel jaw members for grasping an object

and whereby pivoting the handle portions toward each other will close the opposing jaw members to grasp an object;

said first and second members may rotate relative to said opposing swivel jaw members along an arc to best position said first and second members for operation by an user;

a locking means that permits said first and second members to pivotally close its jaw members as desired on an object to be grasped and locks said jaws members so as not to release an object grasped;

said first member having a housing structure between its handle portion sand its jaw portion;

said housing structure having a two opposing side plates, an upper plate, and a lower plate that extends to form the jaw portion;

said housing structure forming a tunnel through which said second member extends;

said second member having a short angled portion joining its jaw portion and extending within said housing and joined to said angled portion;

said short member extending within said housing having a drop extension which joins with a rear extending member orientated singularly to the short member but at a lower level from which the handle portion of said second member extends;

said first member having a fastener extending between the opposing side plates and through the short angled portion of said second member to permit said first and second members to pivot in a plier action;

said locking means including a ratchet gear secured to the short member of said second member and a pawl pick secured to a shaft extending between said two opposing plates of said first member, said pawl pack selectively engaging the teeth of said ratchet gear as said first and second members are pivotally closed members in the opposite direction;

a spring means biasing said pawl pick into engagement with said ratchet gear;

a release means for rotating said shaft extending between said two opposing plates so as to cause the pawl pick to rotate against said spring means and to disengage from said ratchet gear thereby permitting said first and second members to pivotally open from a closed position.

2. A clamping tool according to claim **1** further comprising;

said ratchet gear having a tooth surface along a circle with a radius extending from the pivot point of said first and second members.

3. A clamping tool according to claim **2** further comprising:

elastomeric pads attached to the opposing surfaces of said swivel jaw members.

4. A clamping tool according to claim **1** further comprising:

said opposing swivel jaw members having a detent means for holding said swivel jaw members in select positions relative to the jaw portions of said first and second members.

5. A clamping tool according to claim **1** further comprising:

spring means extending between said first and second members to assist in the pivoting opening of said handle portions and jaw portions.

6. A clamping tool according to claim **5** further comprising:

a stop to prevent rotation of said shaft secured to said pawl pick beyond a certain limit.

7. A clamping tool according to claim **6** further

a lever fastened to said shaft secured to said pawl pick, said lever positioned outside of said housing structure so as to be pushed when desired by the user holding said rear handle portions of the first and second members.

8. A clamping tool according to claim **5** further comprising: a tether loop attached to one of the handle portions of said first and second members.

* * * * *